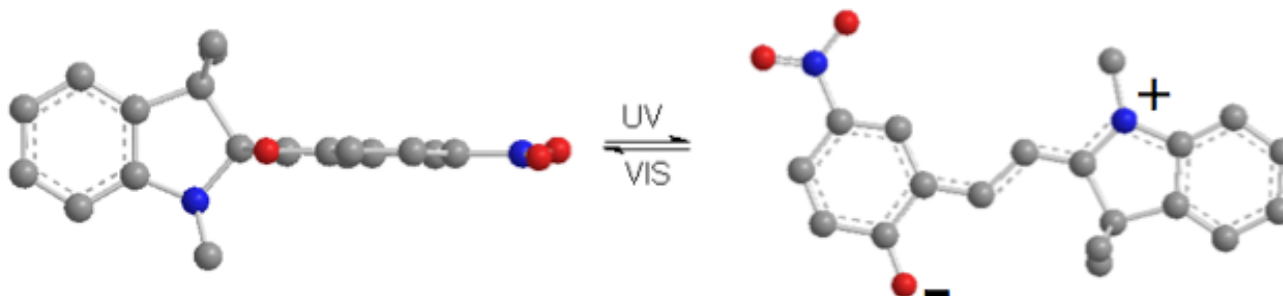


Photo-Controlled Molecular Switches for Flow Modulation In Microfluidic Devices

October 2014

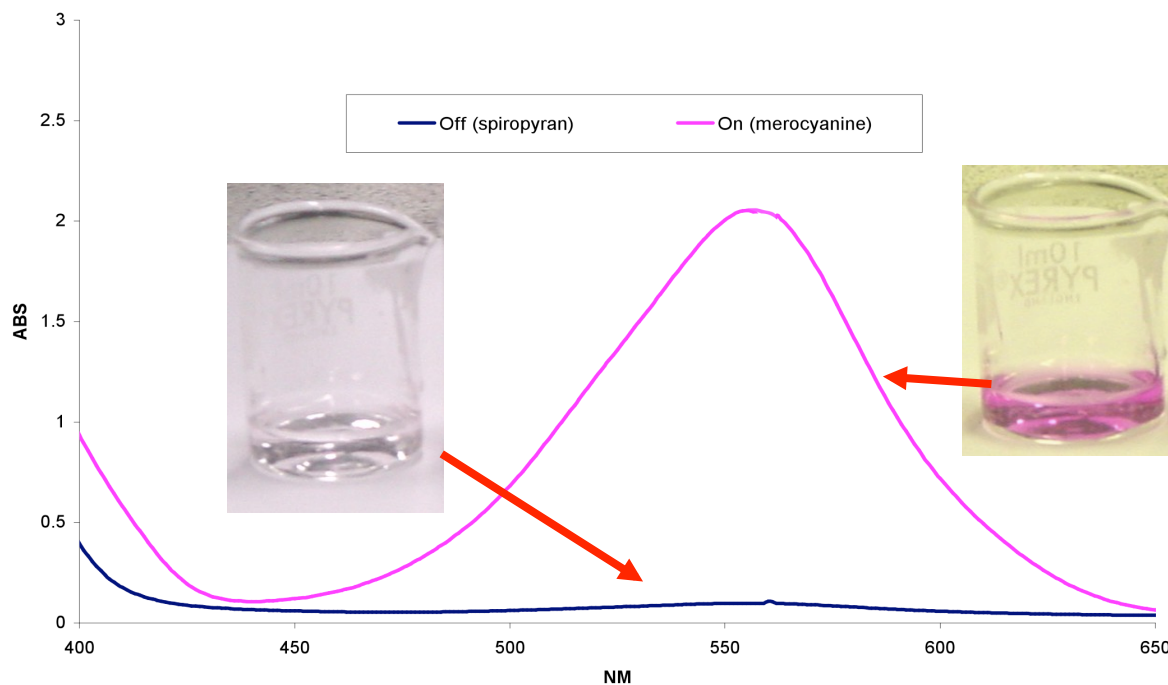
Larisa Florea
Prof. Dermot Diamond

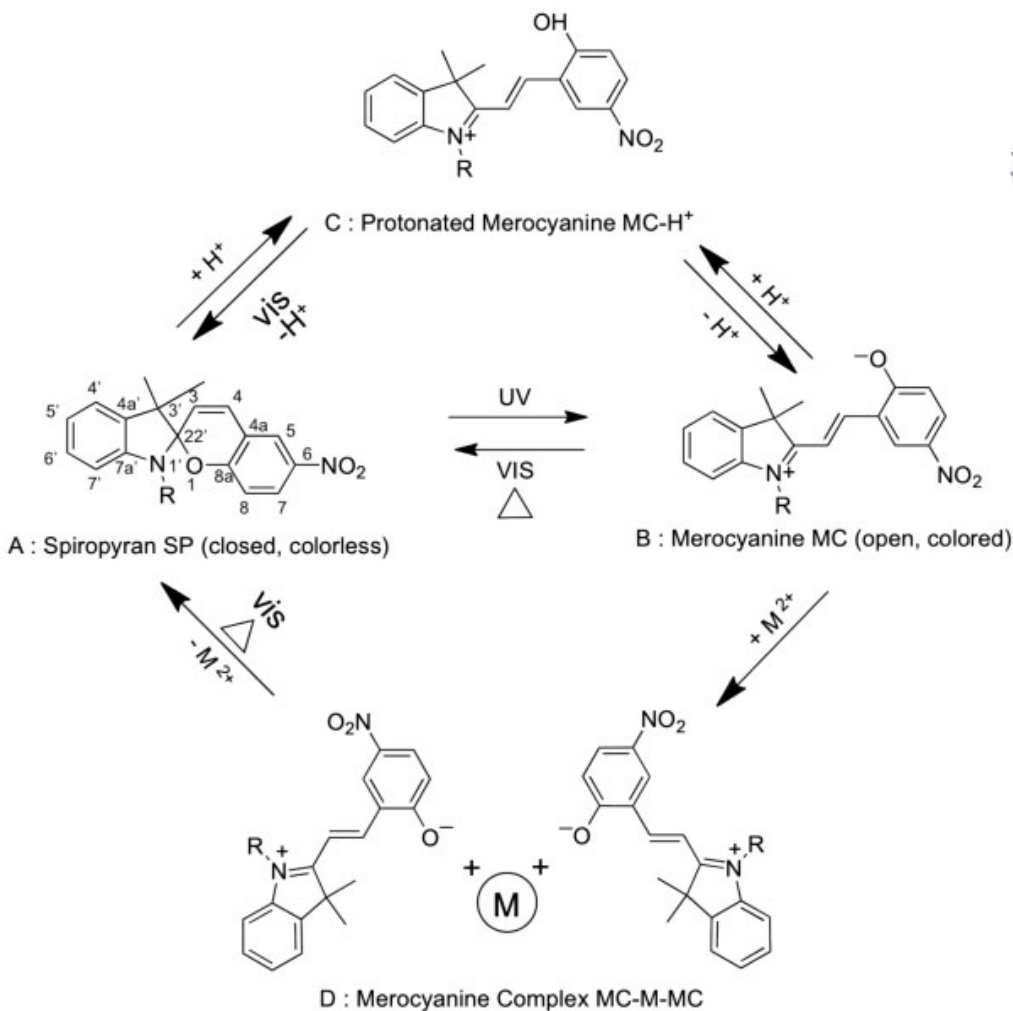
Spiropyrans



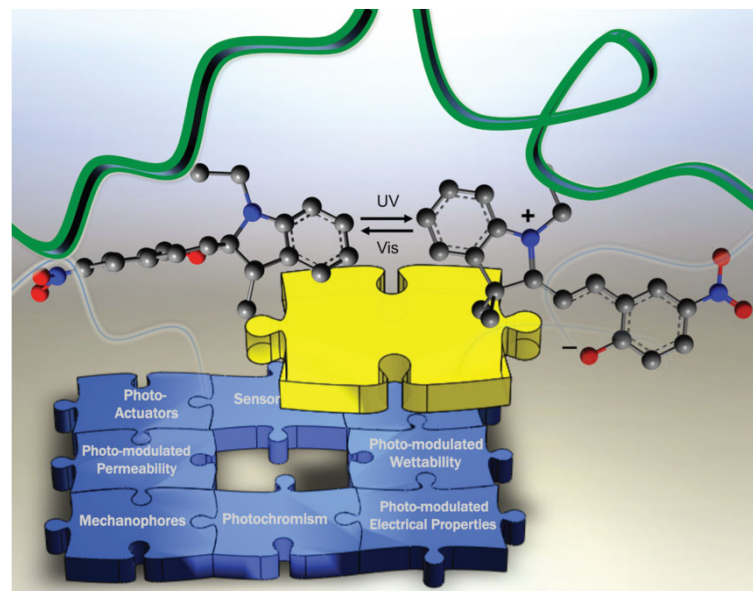
A : Spiropyran SP (closed, colorless)

B : Merocyanine MC (open, colored)





Macromolecular Materials and Engineering



Special Issue:
Advances in Actively Moving Polymers
Guest-edited by Andreas Lendlein

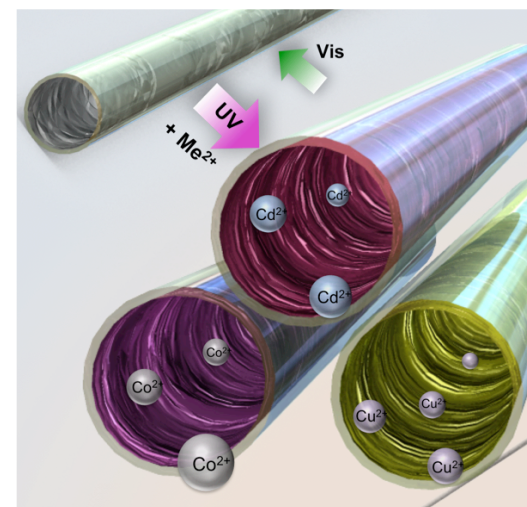
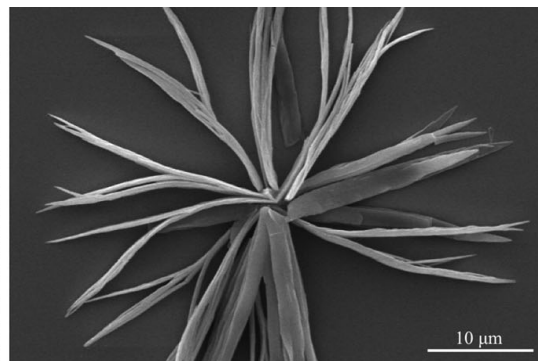
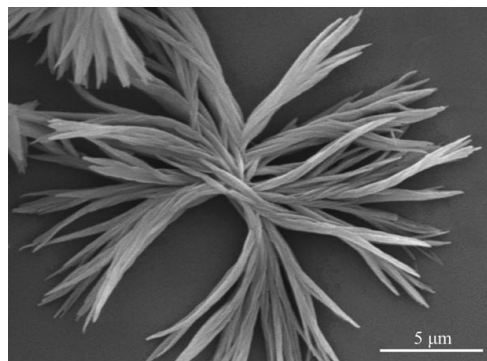
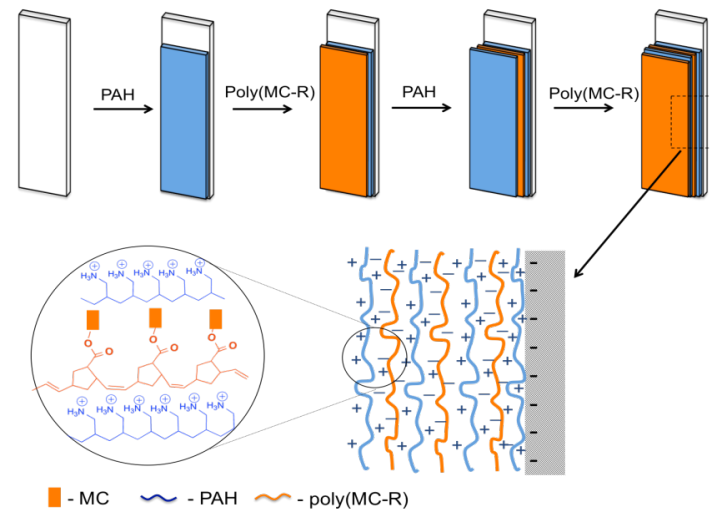
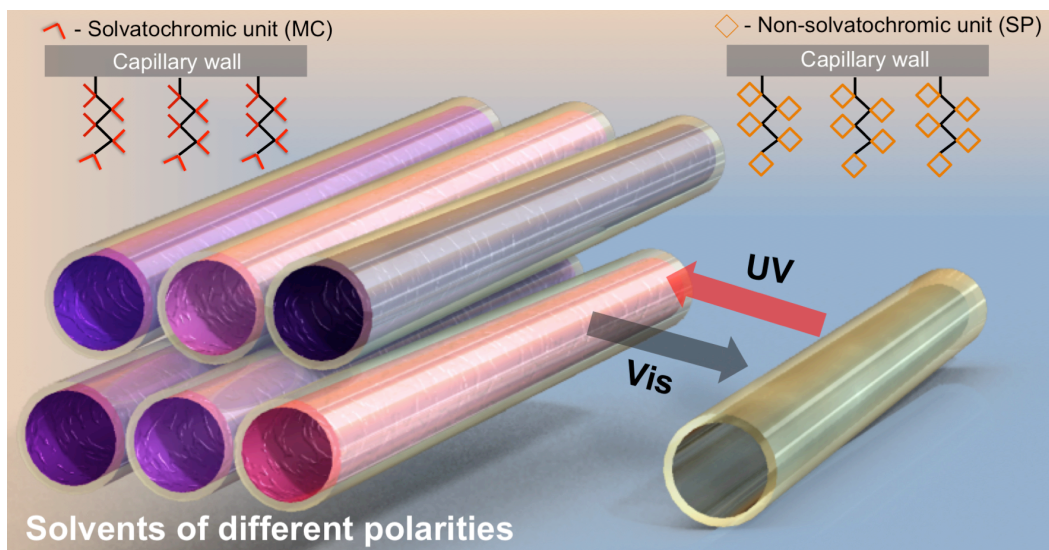
12/2012

WILEY-VCH

L. Florea, D. Diamond and F. Benito-Lopez, *Macromolecular Materials and Engineering*, 2012, 297, 1148-1159.



Spiropyrans

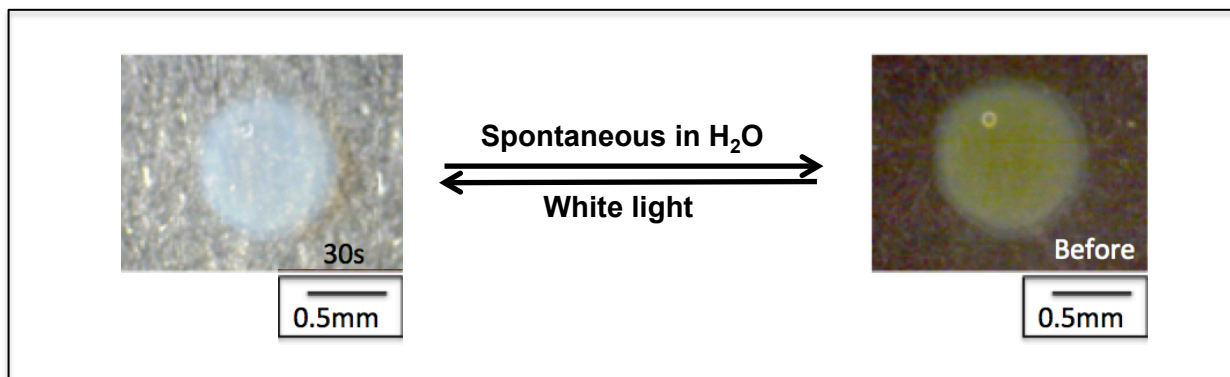
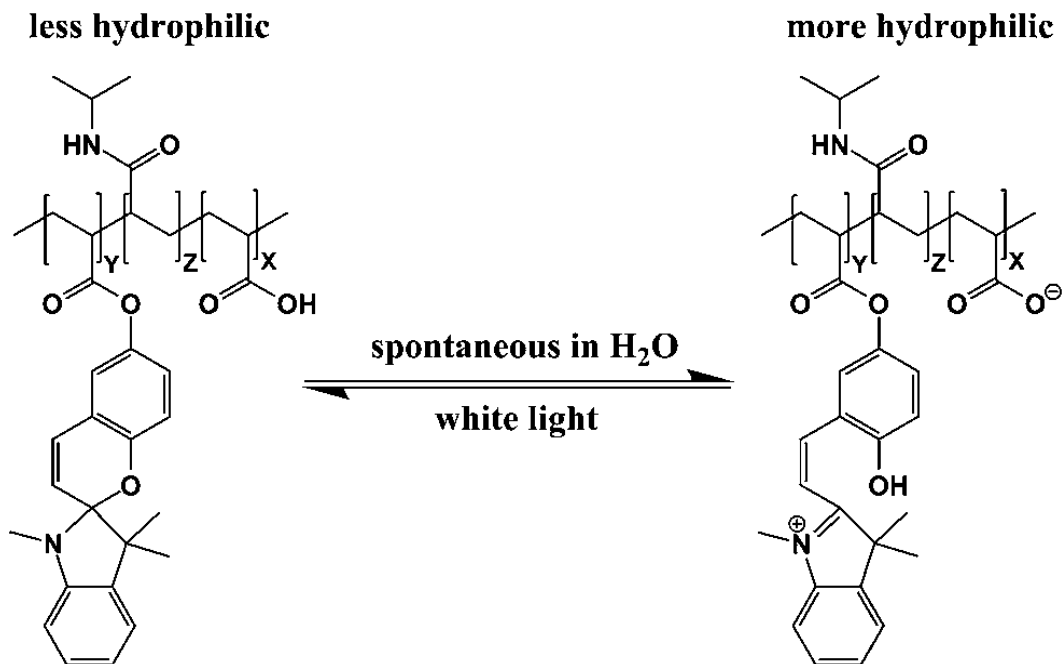


L. Florea, S. Scarmagnani, F. Benito-Lopez, D. Diamond *ChemComm.* 2014.

L. Florea, A. Hennart, D. Diamond and F. Benito-Lopez, *Sens. Actuators B: Chem.*, 2012, 175, 92-99.

L. Florea, A. McKeon, D. Diamond and F. Benito-Lopez, *Langmuir*, 2013, 29, 2790-2797.

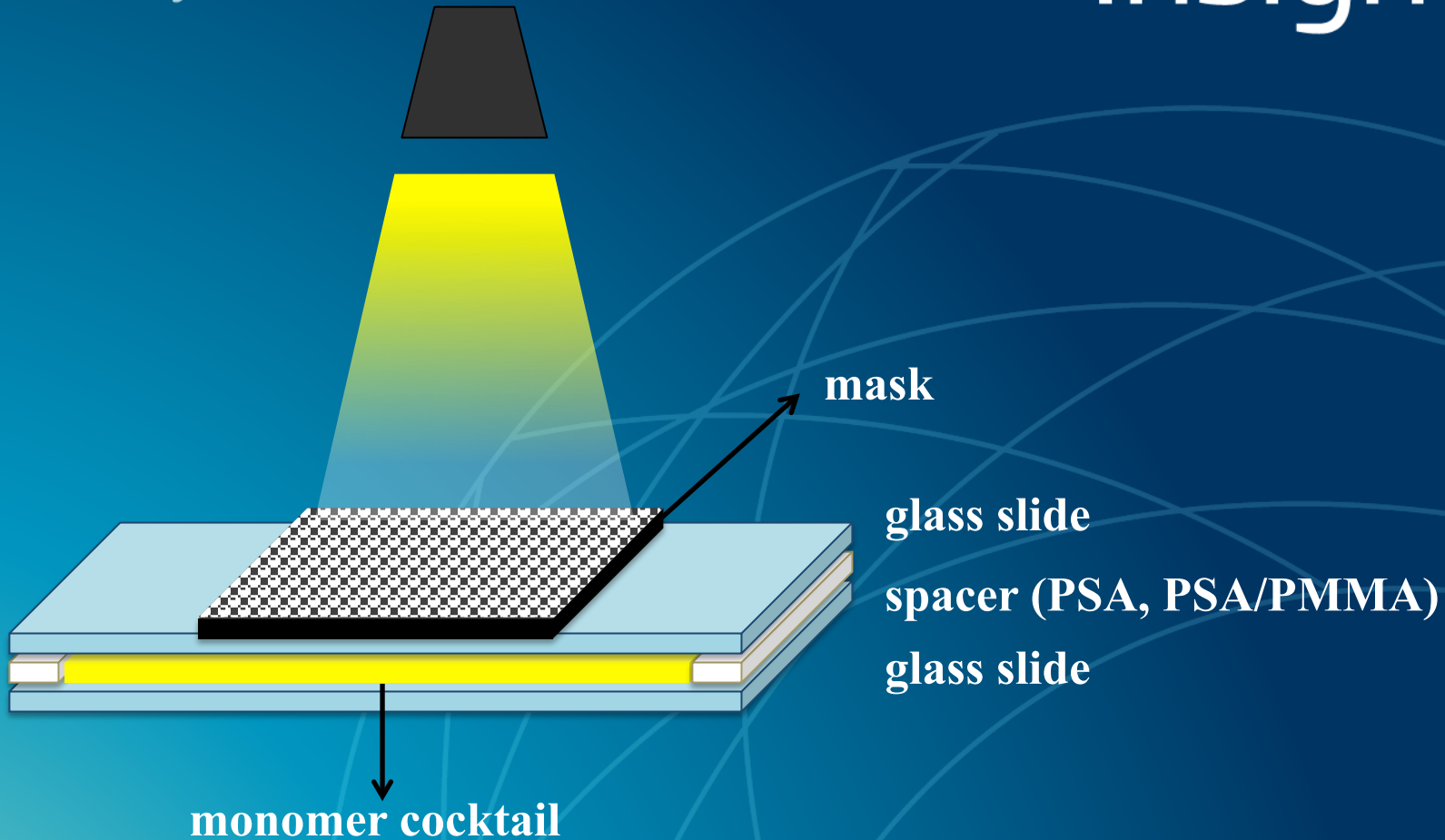
Photo-responsive hydrogels



Microstructures preparation

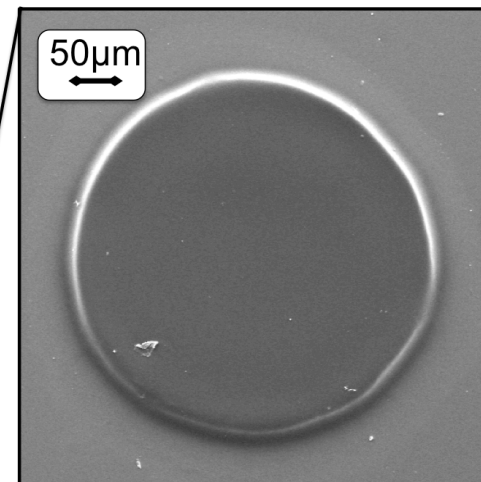
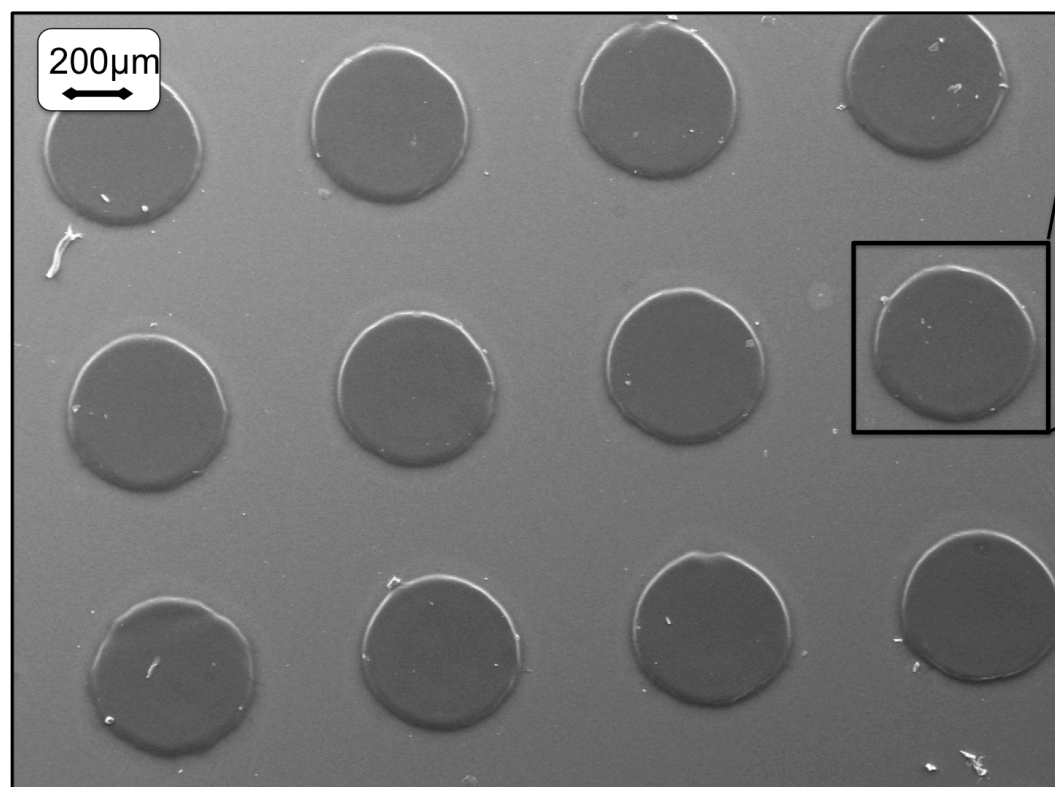
Centre for
Data Analytics

Insight



Micro-patterned hydrogels

Hydrogel microstructures covalently attached to glass substrates were photopolymerised through micro-patterned masks using white light.



- Circular masks of 1mm diameter.
- Hydrogel height: 60μm.
- Polymerisation time: 10-20 seconds.

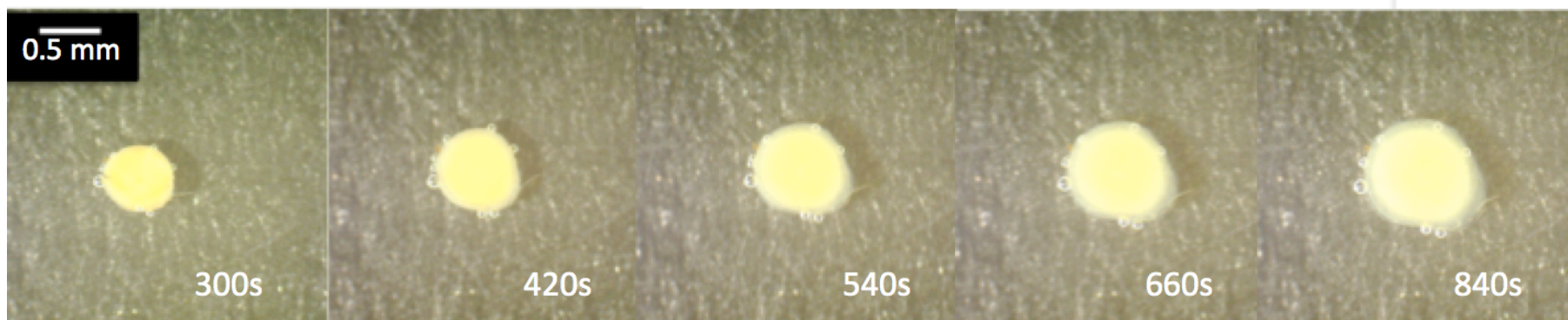
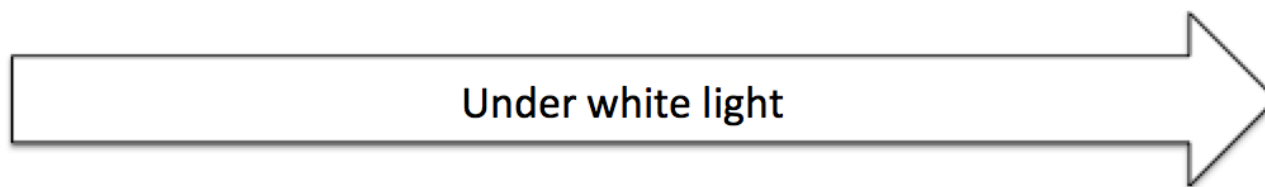
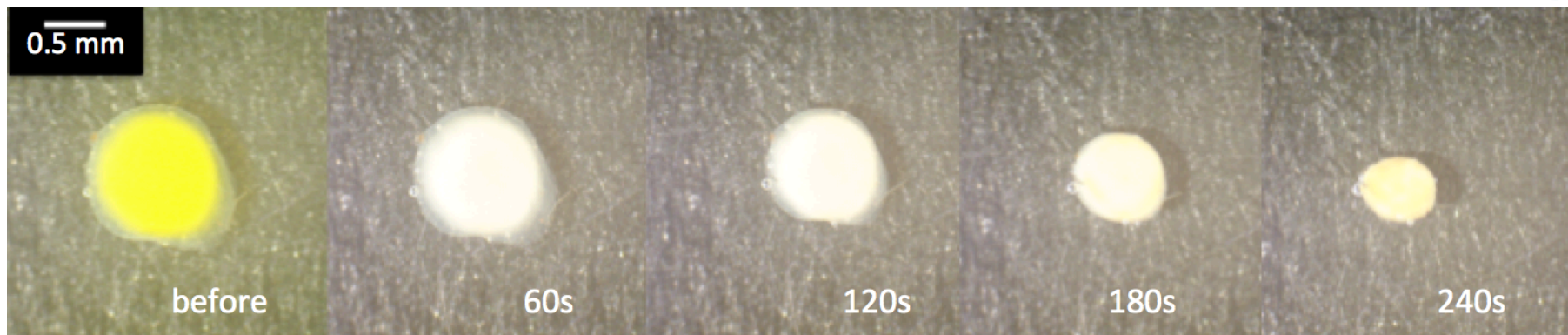




Photo-responsive hydrogels

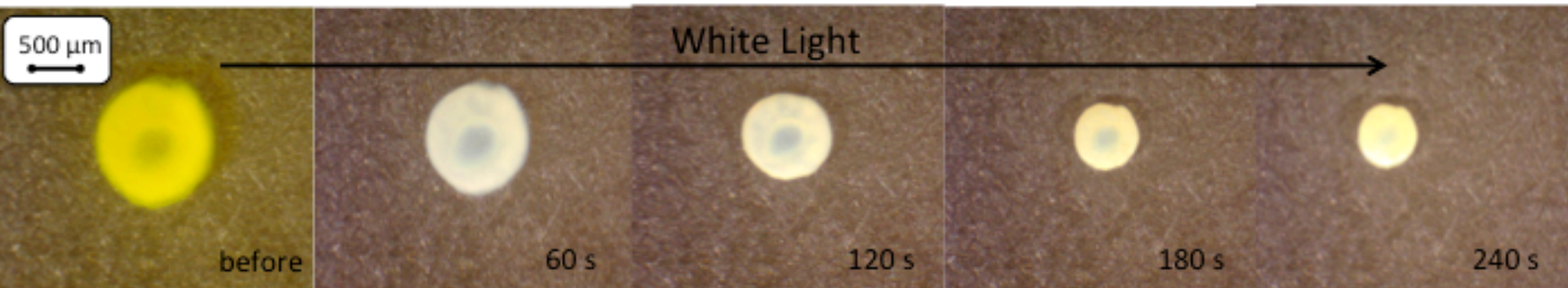
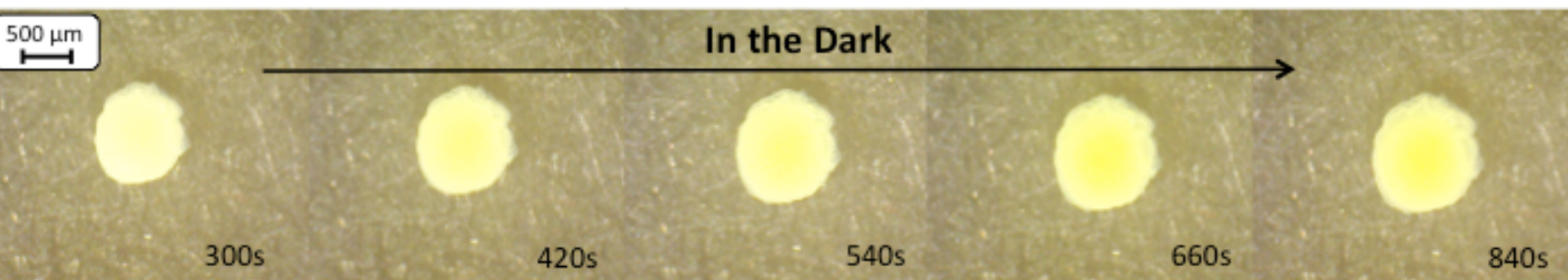


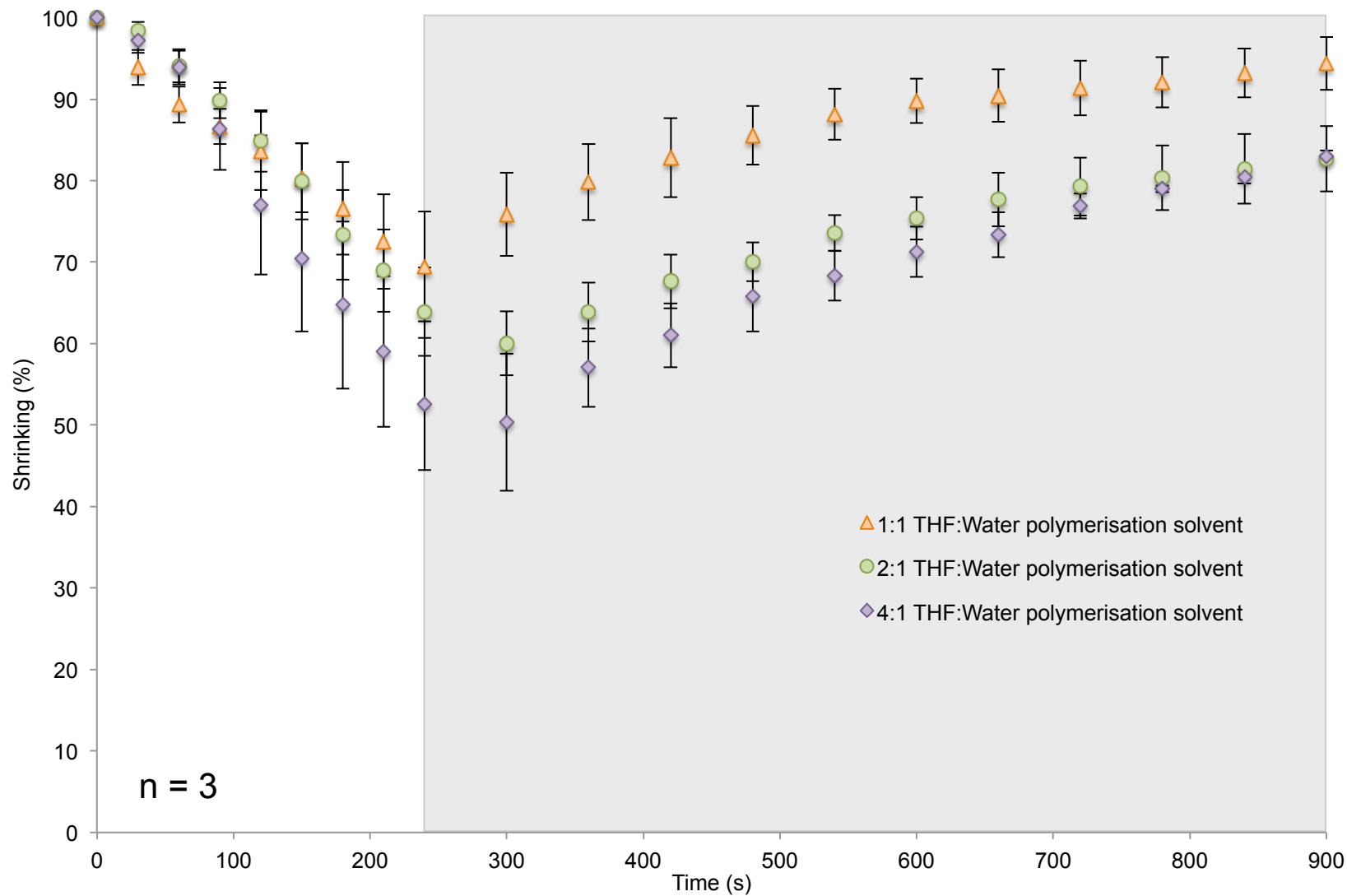


Photo-responsive hydrogels



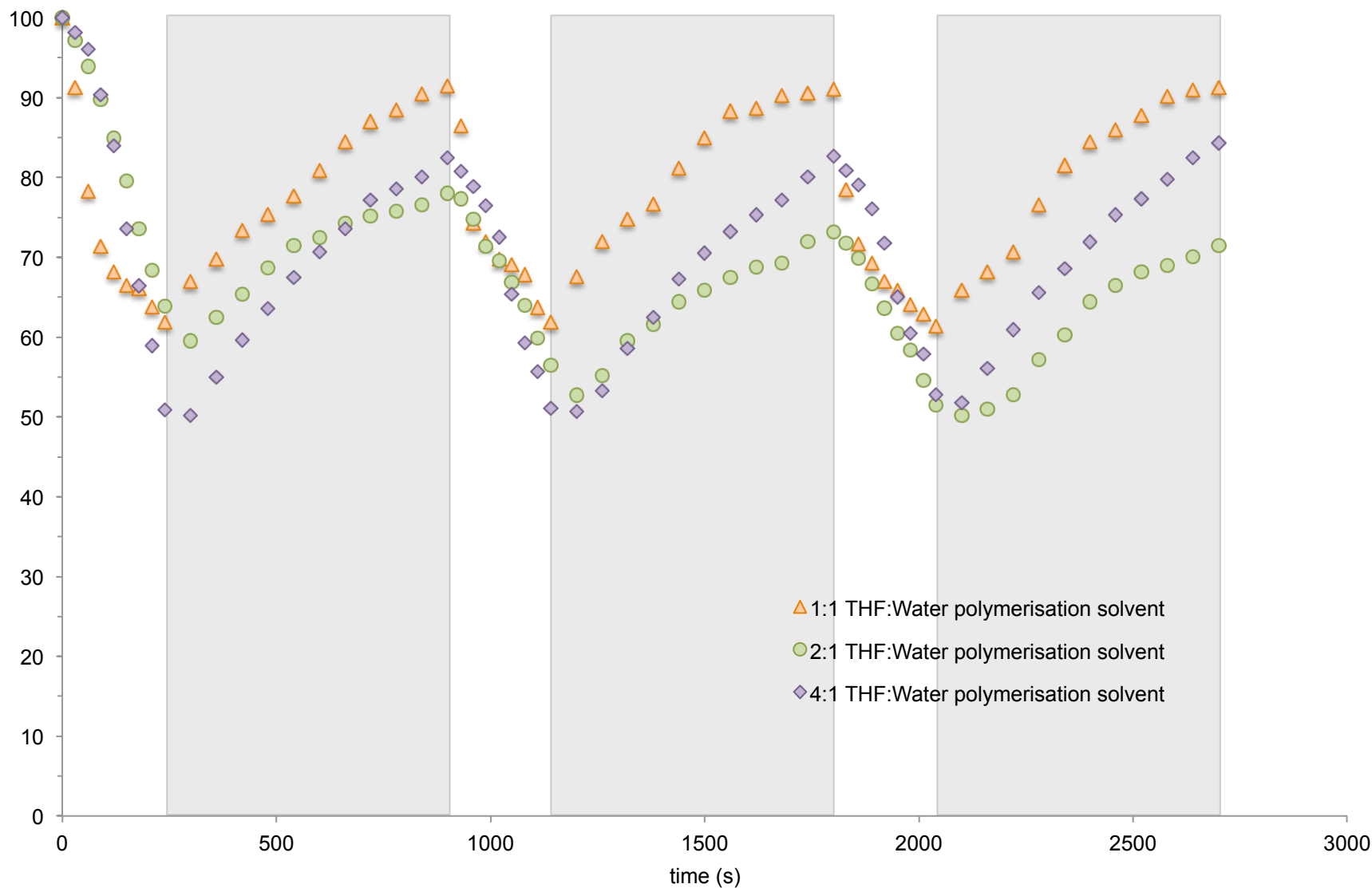


1st irradiation cycle



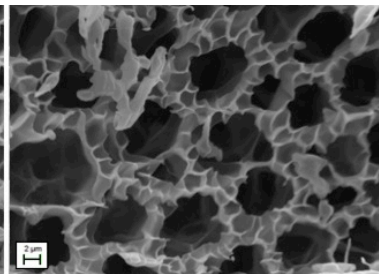


Multiple irradiation cycles

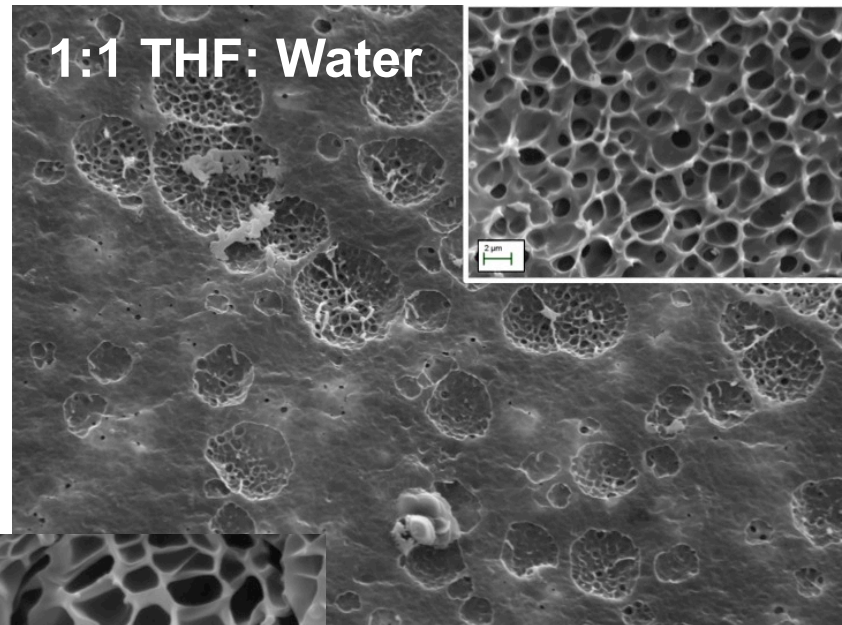


SEM Imaging

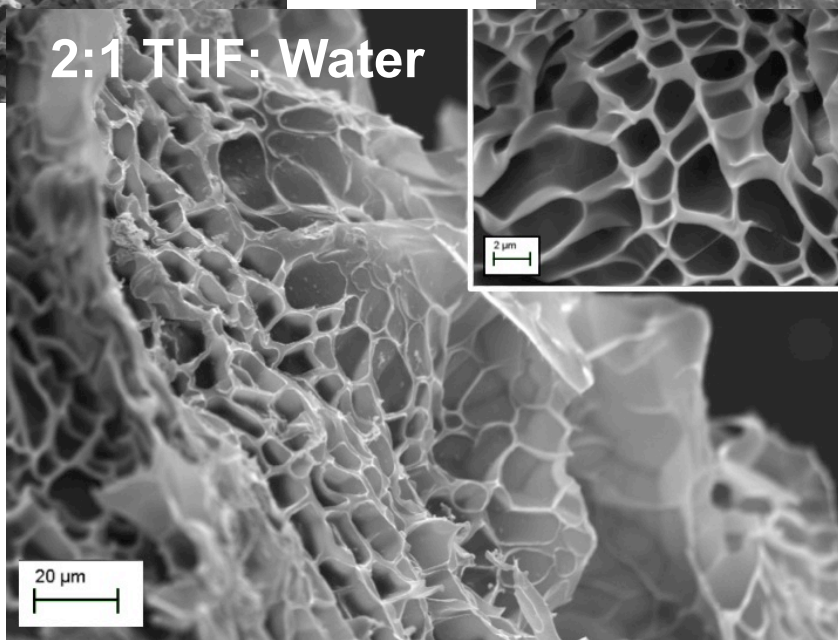
4:1 THF: Water



1:1 THF: Water

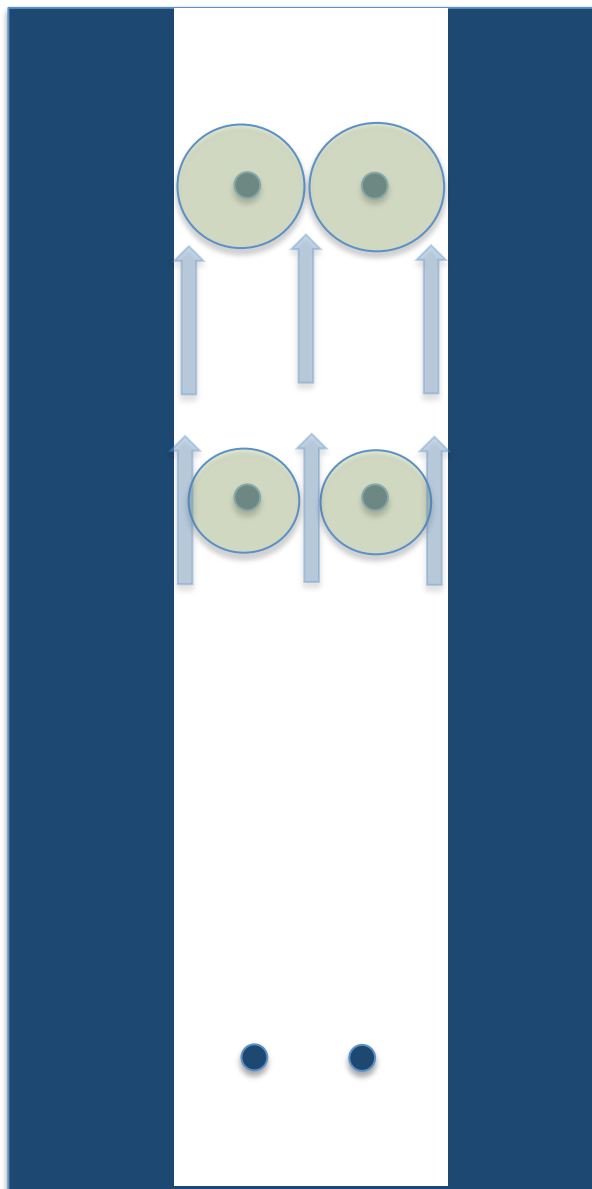


2:1 THF: Water

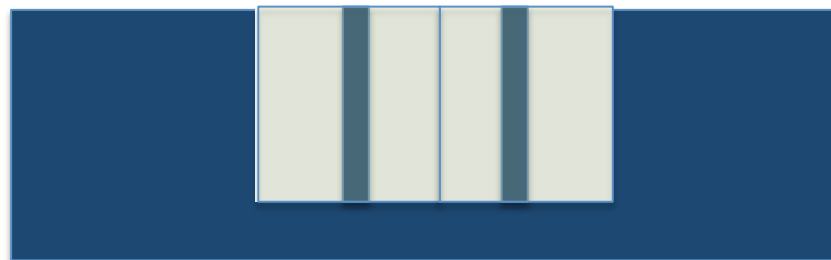




Valve applications

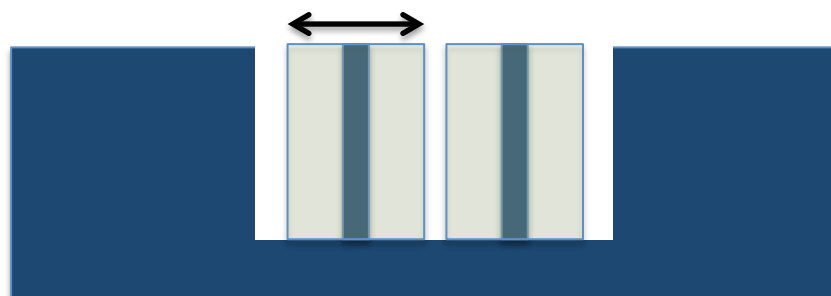


3

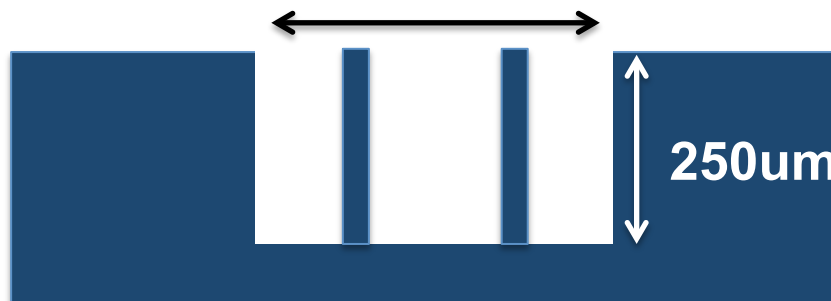


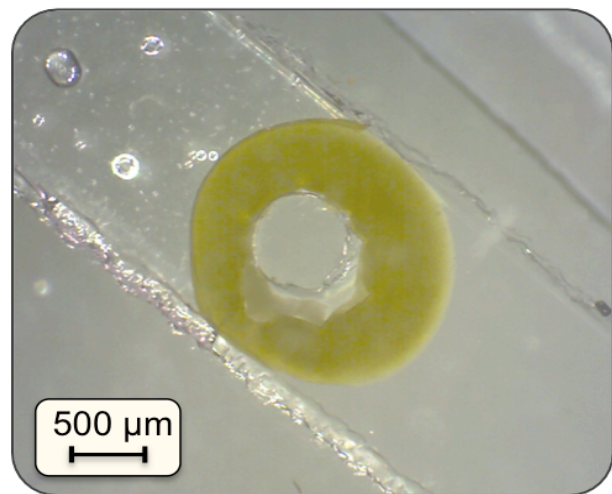
250um gel disks polymerised around pillar using mask

2



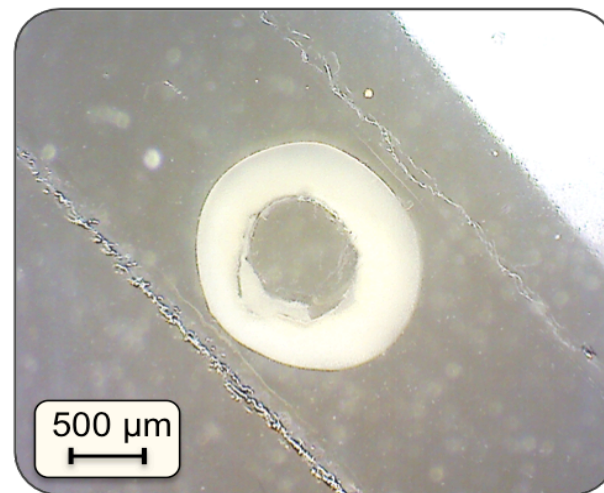
1



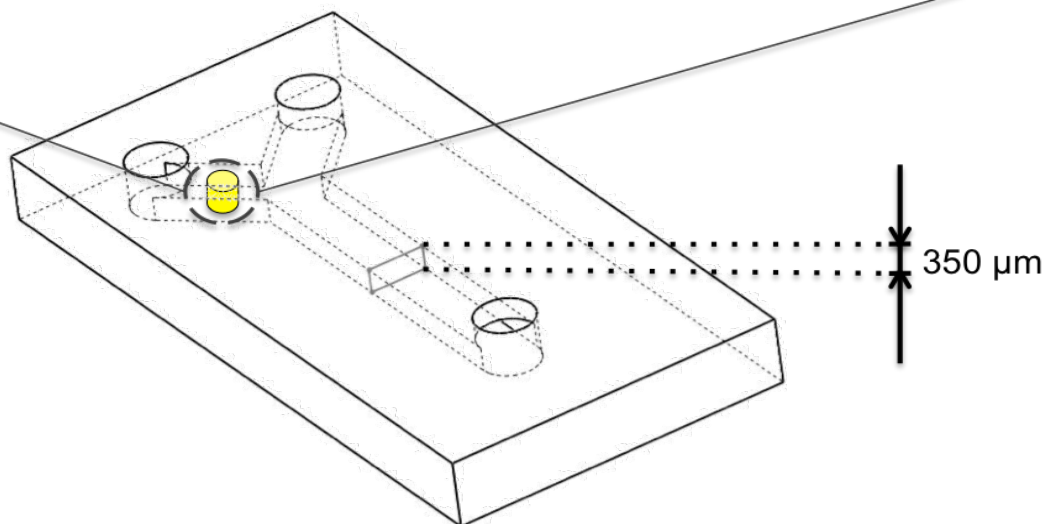


CLOSED

White light
 \longleftrightarrow
 Dark



OPEN



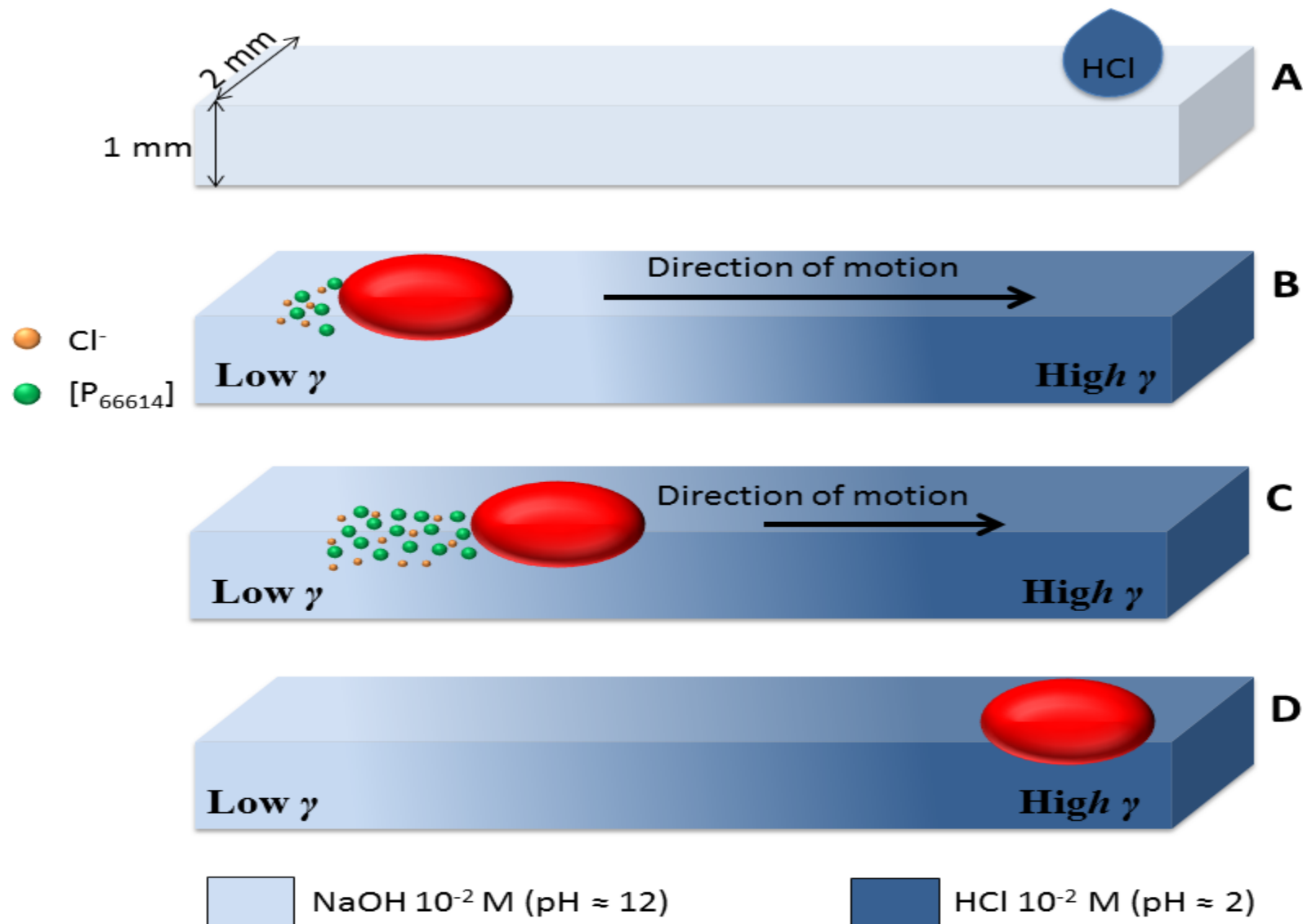


Surfactant-driven vehicles

Chemotactic Droplets



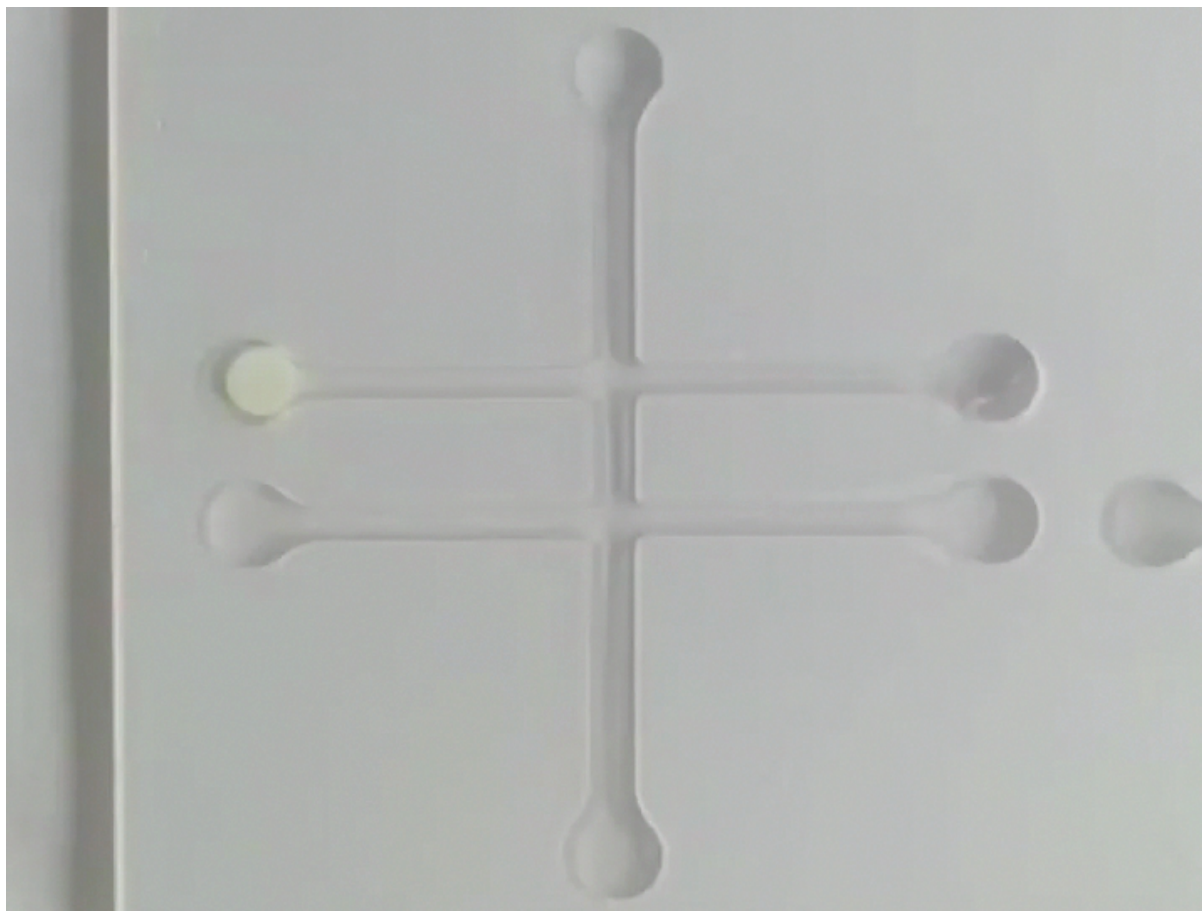
Controlled-release of surfactants





Video 1

Chemoattractant: HCl soaked Gel

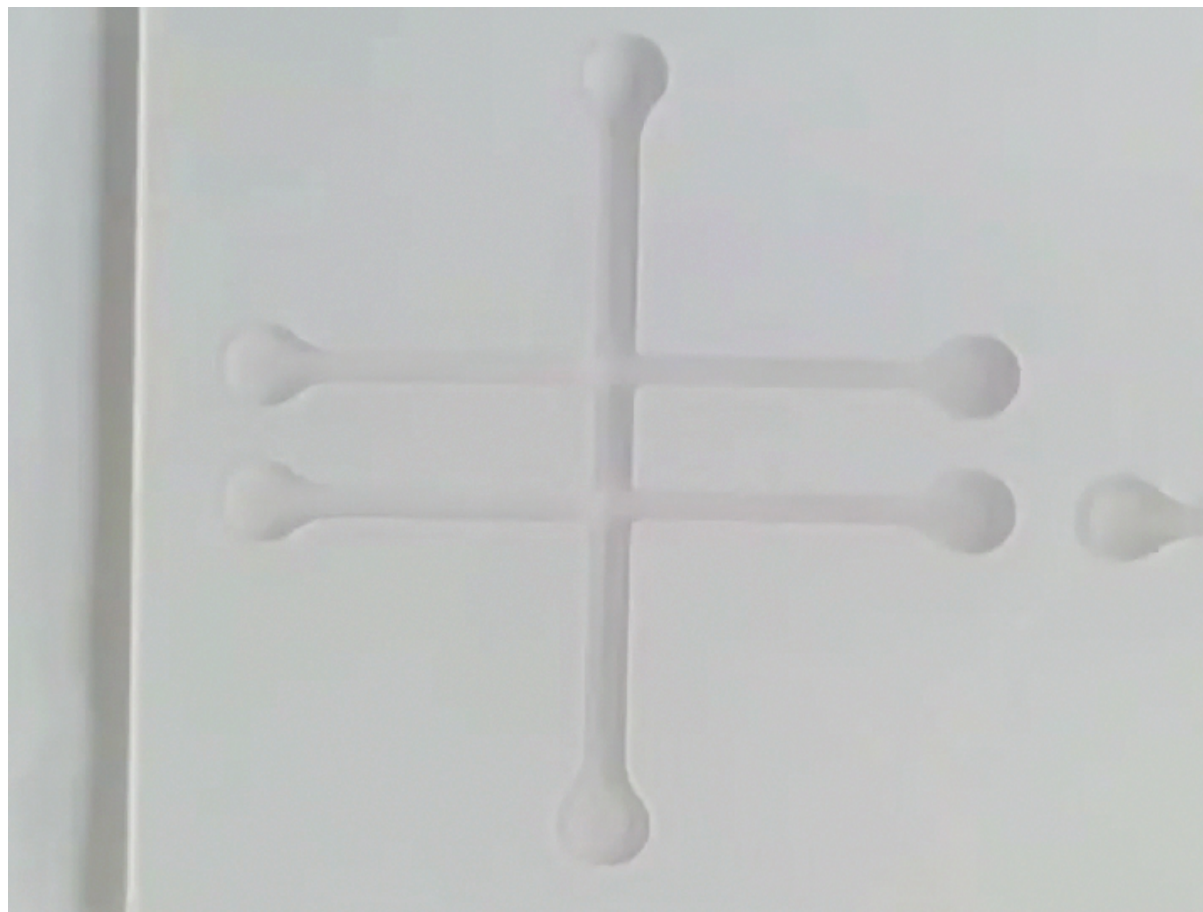


Speed X 4





Video 2: Chemoattractant: Solution of HCl



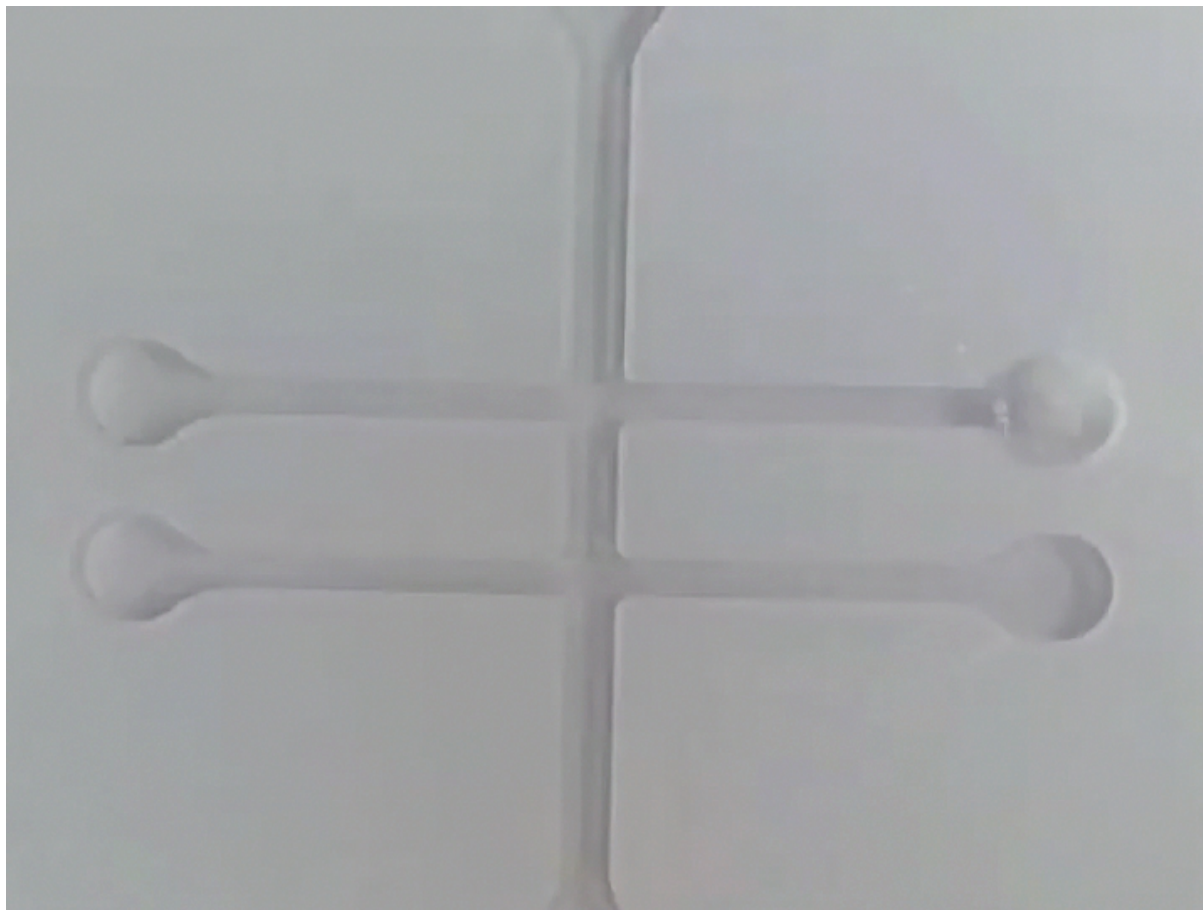
Speed X 2





Video 3

Chemoattractant: NaCl crystals

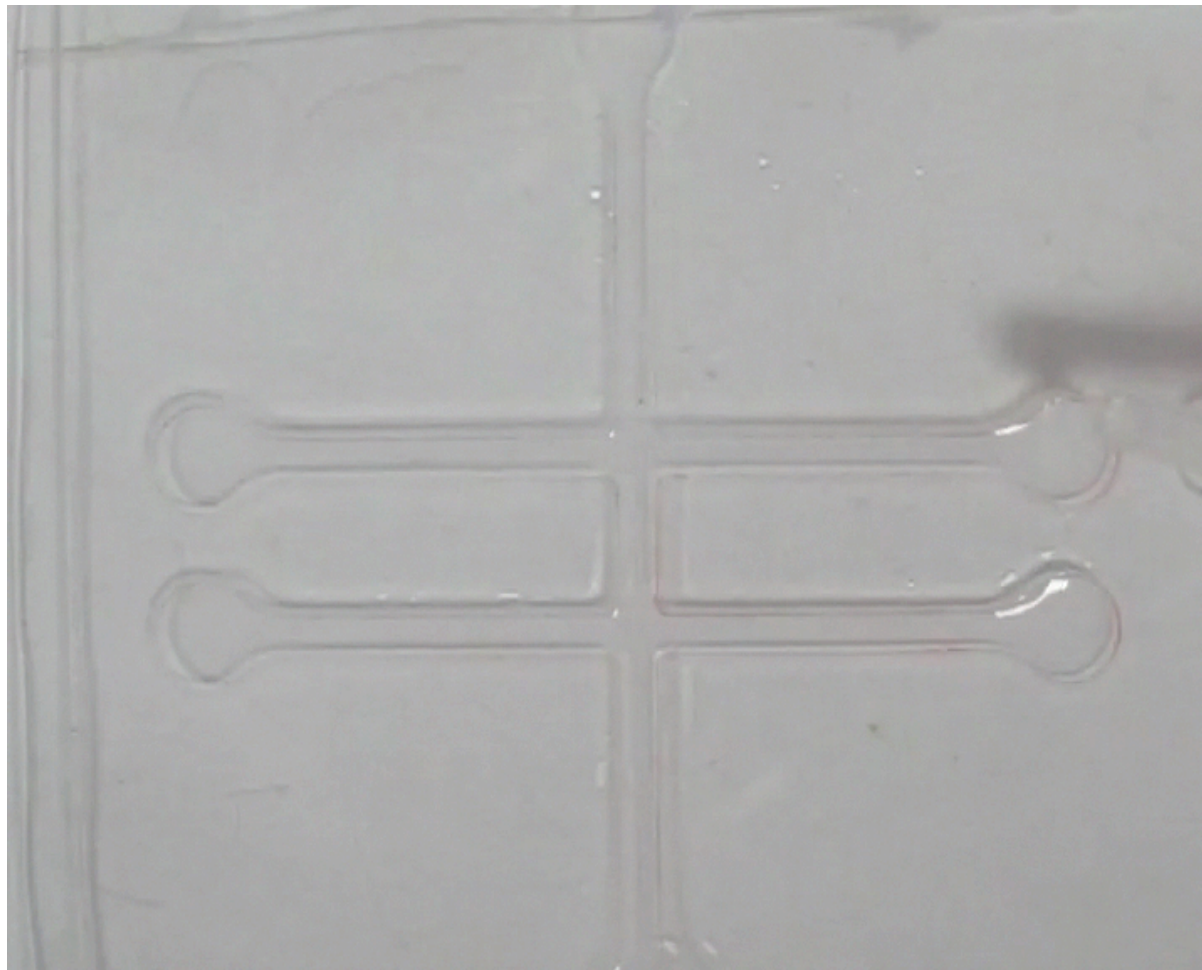


Speed x 4





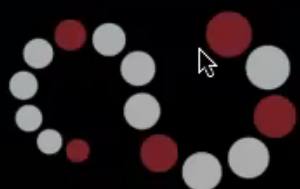
Multiple Chemotactic Droplets



Speed X 2



Electro-activated chemopropulsion



ARC Centre of Excellence for
Electromaterials
Science



ANFF

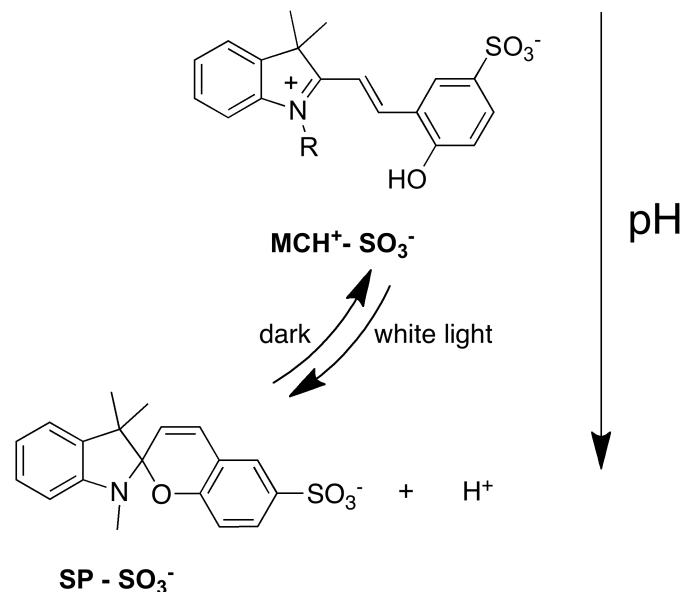
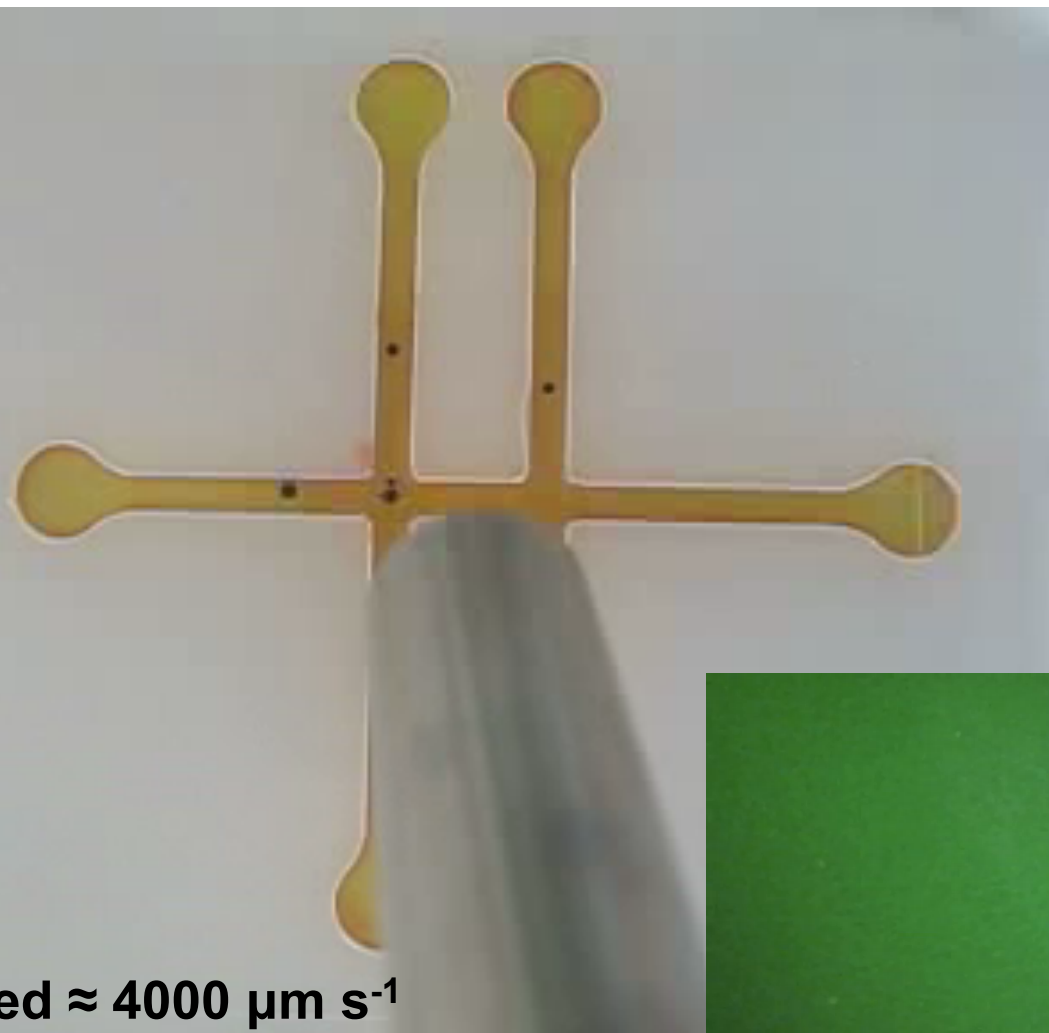


Speed X 4





Photo-activated chemopropulsion



Speed $\approx 100 \mu\text{m s}^{-1}$

Speed x 4

1 cm

[1] Florea, L., Wagner, K., Wagner, P., Wallace, G. G., Benito-Lopez, F., Officer, D. L., Diamond, D. *Advanced Materials* (2014)
DOI: 10.1002/adma.201403007.



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Thank you!